

WHAT IS CLAIMED IS:

- 5
1. A mobile-communications system,
comprising:
- a mobile station;
- a wireless-base station enabled to
10 communicate with the mobile station; and
- a location-information management
apparatus for managing a state of the mobile station
in a network layer upper to a link layer for
managing wireless-communications resources;
- 15 wherein said mobile station is provided
with wireless-communications means for transmitting
and receiving a signal with the wireless-base
station in an active state in the link layer for
managing the wireless-communications resources,
- 20 discontinuous-receiving means for discontinuously
receiving a control signal from said wireless-base
station in the link layer in a state different from
the active state, and first state-management means
for creating a state-transition signal in response
- 25 to a paging signal included in said control signal,
- wherein said location-information
management apparatus is provided with second state-
management means for managing whether the state of
said mobile station in the network layer is active
- 30 or idle, and area-management means for managing
information regarding a cell to which the mobile
station in the active state belongs and information
regarding a location-registration area to which the
mobile station in the idle state belongs,
- 35 wherein a period in which the mobile
station in the active state is neither transmitting
nor receiving is measured in the link layer and in

the network layer so that the state of said mobile station is changed to a state different from the active state when the period exceeds a predetermined period,

5 wherein a signal destined for the mobile station in the state different from the active state in at least one of the network layer and the link layer is accumulated in said location-information management apparatus or said wireless-base station,
10 and the signal destined for said mobile station is transmitted after the state of said mobile station is changed to the active state, or discontinuously transmitted to said mobile station with the paging signal of said mobile station created in said
15 wireless-base station,

 and wherein management of state transition of the mobile station in the network layer and management of state transition of the mobile station in the link layer are performed independently.
20

2. A line concentrator connected to a
25 plurality of the wireless-base stations which line concentrator is for use in the mobile-communications system as claimed in claim 1, comprising:

 communications means for relaying the signal between said location-information management
30 apparatus and the wireless-base station; and

 route-management means for managing route information indicating a transfer route of the signal to said mobile station.

35

3. The line concentrator as claimed in claim 2, further comprising:

5 timer means for timing a period for which a signal transmission associated with the mobile station is not being performed; and

route-management means for deleting the route information for said mobile station from storage means when the timed period exceeds a predetermined period.

10

4. The line concentrator as claimed in claim 2, further comprising:

15 route-management means for updating the route information for said mobile station based on a request from said mobile station or said wireless-base station.

20

5. The line concentrator as claimed in claim 2 that is further connected to a plurality of the wireless-base stations,

25 wherein, when the signal destined for the mobile station is received and when the route information regarding said mobile station is not stored in storage means, said signal destined for the mobile station is transmitted to said wireless-base stations.

30
35

6. The line concentrator as claimed in

claim 2,

wherein said route-management means maintains the route information of said mobile station operating in a battery-saving state in the link layer that is different from the active state, while the route information of said mobile station operating in an idle state different from said active state is deleted.

10

7. A location-information management apparatus for use in a mobile-communications system having a mobile station for conducting wireless communications in an active state in a link layer and for discontinuously receiving a control signal in a state different from said active state, and a wireless-base station for communicating with the mobile station, comprising:

state-management means for managing whether the state of the mobile station in a network layer upper to the link layer for managing wireless-communications resources is active or idle;

area-management means for managing information regarding a cell to which the mobile station in said active state belongs and information regarding a location-registration area to which said mobile station in said idle state belongs; and

timer means for timing a period in which a signal transmission associated with the mobile station is not being performed;

wherein the state of said mobile station in the network layer is changed to a state different from the active state when the period exceeds a predetermined period,

and wherein, when a signal destined for

the mobile station in the idle state in the network layer is accumulated, a paging signal for paging said mobile station is transmitted to a plurality of the wireless-base stations, a state-transition
5 signal created by said mobile station in response to said paging signal is received, and the signal accumulated that is destined for said mobile station is transmitted in response to a state-transition report indicating that the mobile station undergoes
10 a state transition.

15 8. A wireless-base station for use in a mobile-communications system having a location-information management apparatus for managing a state of a mobile station in a network layer upper to a link layer, comprising:

20 communications means for wirelessly communicating with the mobile station in an active state in the link layer for managing wireless-communications resources;

discontinuous-transmitting means for
25 discontinuously transmitting control information to the mobile station in a state different from said active state;

management means for managing information pertaining to the mobile station wirelessly
30 communicating; and

timer means for timing a period in which the mobile station in the active state neither transmits nor receives;

wherein, in the location-information
35 management apparatus, whether the state of said mobile station in said network layer is active or idle is managed, and information regarding a cell to

which the mobile station in said active state belongs and information regarding a location-registration area to which the mobile station in said idle state belongs are managed,

5 wherein the state of said mobile station is changed to a state different from the active state when the period timed with said timer means exceeds a predetermined period,

10 and wherein, when a signal destined for the mobile station in a state different from the active state is received in the link layer, a state-transition signal created by said mobile station in response to a paging signal for paging said mobile station is received, and in response to the state-
15 transition signal indicating that a state transition should be performed, the signal accumulated that is destined for said mobile station is transmitted, or the paging signal and the signal destined for said mobile station are discontinuously transmitted.

20

9. The wireless-base station as claimed
25 in claim 8, wherein said management means deletes information pertaining to the mobile station transitioned to the idle state in said link layer that is different from the active state from an assignment table for managing a mobile station which
30 establishes a wireless link so as to communicate.

35 10. A mobile station enabled to communicate with a wireless-base station, comprising:

wireless-communications means for transmitting and receiving a signal with the wireless-base station in an active state in a link layer for managing wireless-communications
5 resources;

discontinuous-receiving means for discontinuously receiving a control signal from said wireless-base station in a state different from said active state;

10 state-management means for creating a state-transition signal in response to a paging signal included in said control signal; and

timer means for timing a period in which neither transmission nor reception takes place in
15 said active state;

wherein whether a state of said mobile station in a network layer upper to the link layer is active or idle is managed by a location-information management apparatus, and in the
20 location-information management apparatus, information pertaining to a cell to which said mobile station in said active state belongs and information pertaining to a location-registration area to which said mobile station in said idle state
25 belongs are managed,

wherein the state of said mobile station transitions to a state different from the active state when the period timed with said timer means exceeds a predetermined period,

30 and wherein, when in a state different from the active state in at least one of said network layer and said link layer, after said state-transition signal is transmitted, the signal accumulated in said location-information management
35 apparatus or said wireless-base station is received, or the paging signal and a signal destined for the mobile station itself are discontinuously received

from said wireless-base station.

5

11. The mobile station as claimed in claim 10 that is further adopted to change, in response to changing the state in one of said link layer and said network layer, the state of the other of said link layer and said network layer.

15

12. A communications method for use in a mobile-communications system consisting of a mobile station, a wireless-base station enabled to communicate with said mobile station, and a location-information management apparatus for managing a state of the mobile station in a network layer upper to a link layer for managing wireless-communications resources, comprising the steps of:

the mobile station, in an active mode in said link layer for managing the wireless-communications resources, receiving a signal from the wireless-base station;

timing, in the link layer and in the network layer, a period in which said mobile station neither transmits nor receives after receiving said signal;

transmitting to said wireless-base station, when the period timed in the link layer has exceeded a predetermined period, a state-transition signal indicating that a state in the link layer of said mobile station should transition to a state different from the active state;

transmitting to said location-information

management apparatus, when the period timed in the network layer has exceeded a predetermined period, a state-transition signal indicating that the state in the network layer of said mobile station should
5 transition to an idle state; and

said mobile station discontinuously receiving a control signal from said wireless-base station in the link layer in a state different from the active state.

10

15

20

25

30

35